Power Distribution and Data Acquisition for a Free-falling Oceanographic Profiling System (DURIP)

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Grant Number: N00014-05-1-0757
http://argon.oce.orst.edu/biooptics/projects.htm

LONG-TERM GOALS

The long-term goal of our research group is quantification of the interactions between small-scale biological and physical processes within the upper ocean. This project has addressed that goal by expanding our technical capabilities for vertical profiling of sub-1m scale bio-optical and physical properties.

OBJECTIVES

The success of high-resolution profiling observations rests on the ability to conduct routine time and/or spatial series of profiles with multi-instrument systems that possess excellent time and depth resolution of all parameters. There are three primary components to this: 1) clean power to all instruments, 2) accurately time-resolved measurements, and 3) a routinely dependable deployment and recovery system. Our on-going ONR-supported research has permitted us to make advances in the time-resolution area, but we have serious needs in the two other areas.

Our DURIP objectives are to:

- purchase a Power Distribution System that can replace the obsolete MODAPS+ unit that we have been using since 1997. The objective is to provide clean power to multiple instruments (see below).

- accurately measure the horizontal velocity field in front of the sinking profiler. We will meet that objective through the integration of a 600 kHz ADCP onto our profiling system.

- enhance our fiber optic winch and cable system for deployment and recovery system.

APPROACH

The principal component of the DURIP instrumentation consists of a Power Distribution System (PDS) for the profiling system.

The PDS will be used in conjunction our existing 500m of fiber optic sea cable which contains 2 electrical conductors and 3 optical fibers. The PDS will consist of a deck unit (DU) and a subunit (SU).

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2006	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Power Distribution and Data Acquisition for a Free-falling Oceanographic Profiling System (DURIP)	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **College of Oceanic and Atmospheric Sciences 104 Oceanography Admin Bldg Oregon State University Corvallis, OR 97331-5503**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**4**	

The Deck Unit will provide power down the sea cable to the Sub Unit located in the profiler. The Sub Unit will distribute the power to all of the devices on the profiler. The power distribution requirements of the SU are to:

- Provide 14 individually controllable electrically isolated power ports.
- Allow us to switch the power on and off to individual ports, via a command interface.
- Provide 12 ports that supply 15VDC at maximum output of 20W (1.3A).
- Provide 2 ports that provide 24VDC at a maximum output of 50W (2.1A).
- Provide a total power budget of 350W.
- Supply voltage to the sea cable within its safe working voltage.
- Supply clean power with power isolation between ports.

The PDS will be integrated into our software system for a fully-operational data acquisition system.

The second component involved the purchase of a 600 kHz ADCP to be integrated into our profiling system. We used a demo system from NORTEK during our August/September 2005 field work and a 1 MHz ADCP demo during the 2006 field system. We are comparing the 600 kHz and 1 MHz results so that we can make a decision about purchasing a unit from RDI or Nortek.

The third component is the continuing improvement of our deployment system. Our new winch and cable system benefited from additional upgrades prior to the 2005 and 2006 field seasons under funding from this DURIP.

WORK COMPLETED

The purchase of all new technical components under this DURIP funding has now been completed. The new power distribution system is being fabricated by WetLabs, Inc. We will take delivery of the new system in March, 2008.

We completed field tests with a 600 kHz ADCP and a 1 MHz ADCP on our profiling system during the August/September 2005 cruise and the July 2006 cruise. We have determined that a 600 kHz RDI system is the best match for our profiling system.

We have completed the upgrade of the winch/cable system. We have used DURIP funds to increase the optical signal through the optical slip rings and the fiber optic cable. We have also added a power detection system to the winch/cable operation so that we can detect signal loss in each of the optical pathways.

RESULTS

The winch and ADCP components of the DURIP instrumentation have contributed to the scientific results reported for Grant#: N00014-04-1-0277, *Finescale Planktonic Vertical Structure: Horizontal Extent and the Controlling Physical Processes*. Please see that report for scientific details.

Figure 1. Hydraulic winch with fiber optic cable and fiber optic slip rings. Winch operator can control payout rate precisely so that instrument package can descend in "free-fall" mode.

IMPACT/APPLICATIONS

The new instrumentation will provide new research capabilities for nearshore, continental shelf research as well as open ocean research. Our profiling and data acquisition system extends both the time and space scales of resolution as well as providing integration of multiple instrumentation suites into accessible data sets. The modifications that we will make to our free-fall profiling system this year will permit investigation of physical and biological processes on the small-scale (centimeters to meters) across a wide range of ocean conditions. The capability to conduct extended time series of centimeter-scale vertical profiles of this range of parameters will provide a new "window" through which to observe the linkages between physics and biology in the upper ocean. Resolution of these linkages is essential for our understanding of ocean processes.

TRANSITIONS

The incorporation of this new instrumentation into our profiling system extends our ability to define the range of forcing conditions under which small-scale structure is formed and maintained. We will now be able to work under a much wider range of conditions and in a wider range of locations than was possible with the earlier version of our profiling system.

RELATED PROJECTS

The proposed instrumentation is tightly linked to another ongoing project supported by DOD.

Finescale Planktonic Vertical Structure: Horizontal Extent and the Controlling Physical Processes - ONR support (N00014-04-1-0277) to Dr. Timothy J. Cowles

This currently-funded project is one component of the DRI, *Layered Organization of the Coastal Ocean,* and focuses on planktonic small-scale processes over the Oregon continental shelf.